PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in and relating to Driving Mechanism employing Planetary Gearing

We, THE BRITISH THOMSON-HOUSTON COMPANY, LIMITED, a British Company, having its registered office at Crown House, Aldwych, London, W.C.2, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to driving mechanisms and particularly to an improved driving mechanism wherein one of the gears of a planetary system is adapted to be held to provide a driving connection between a driving and driven shaft, the mechanism being arranged also to limit the torque transmitted through the driving connection to a predetermined safe operating value.

Such an improved driving mechanism in accordance with the invention comprises an electric driving motor and a driven member, means including a planetary gearing for providing a driving connection between the motor and the driven member, the planetary gearing including a sun gear adapted to be driven by the motor, a ring gear and a planet gear arranged in engagement with the sun and ring gears and rotatably supported by the driven member, and electromagnetic brake means responsive to energization of the motor for frictionally holding stationary the ring gear to establish the driving connection only when the motor is energized, the electromagnetic brake means being arranged to maintain the driving connection below a predetermined torque but to disestablish the driving connection by allowing slip of the ring gear to occur when the said predetermined torque is exceeded. Conveniently, the electromagnetic brake means comprises a friction plate fixedly connected with the ring gear and a complementary friction plate adapted to be moved into frictional engagement with the first friction plate by means of an electromagnet armature actuated in response to energization of the electromagnet when the driving motor is energized. Means may also be provided for resiliently preloading the electromagnetic brake means.

The invention will now be described with reference to the accompanying drawing.

The drawing is a partial sectional view showing an embodiment of the invention in which a planetary gear system is adapted to provide a driving connection between a motor drive shaft and a driven shaft and an electromagnetic brake is adapted to limit the torque transmitted by the driving connection to a predetermined value and also to provide the driving connection only when the motor is energized.

Referring to the drawing, we have shown a driving mechanism in which a motor 10 is arranged as a driving member and is provided with a drive shaft 11 on which spur gear teeth 12 are formed. The motor is provided with conventional windings adapted to be energized by a suitable source of electrical power supply and is adapted to provide a driving torque to a driven shaft 13 through a set of gearing which engages the spur gear 12. The gearing is mounted in a gear casing 14 which is rigidly secured to the frame of the motor 10 by bolts 15 and is secured to a brake housing 16 by bolts 17. Suitable sealing bushings 18, 19, and 20 are arranged about parts of the driving mechanism to insure against the entrance of foreign substances which might interfere with the proper operation thereof. The torque is transmitted from the motor shaft 11 to the driven shaft member 13 by gearing which includes an intermediate spur gear 21 arranged in engagement with the drive shaft gear 12 and mounted on a countershaft 22 supported by ball bearings 23 and 24 in the gear casing 14. A bevel gear 25 is formed integral with the countershaft 22 so as to be driven by the intermediate gear 21 and is arranged in engagement with a second bevel gear 26 formed on a hub or sleeve 27 provided with a bearing 28 arranged about an upper extension 29 of the driven shaft member 13. The driven shaft is rotatably supported by

anti-friction ball bearings 30 mounted in the gear casing 14 and anti-friction ball bearings 31 mounted in a bearing housing 32 formed in the brake housing 16. Torque is adapted to be transmitted from the bevel gear 26 to the driven shaft 13 through a planetary gearing system which includes a sun gear 33 formed on the hub 27 and arranged in engagement with a pair of planet gears 34 rotatably supported on the driven shaft 13 by bearings 35 arranged about shaft 36 secured to a torque arm or planet cage 37 by clamping rings 38 and 39 and a cover plate 40. The planet cage 37 is formed integral with the driven shaft 13, and torque is adapted to be transmitted from the sun gear 33 to the rotatable planet gears 34 which are adapted to drive the driven shaft 13 by engagement with an internal ring gear 41 adapted to be held stationary through an adjustably preloaded slip brake. In order to insure against damage to the driven mechanism, the ring gear 41 is adapted to be held stationary below a predetermined torque to provide a driving connection between the sun gear 33 and the driven shaft 13 through the planet gears and the supporting planet cage 37 and to be released above a predetermined torque to allow for rotation of the ring gear 41 by the planet gears 34, thereby releasing the driving connection between the motor drive shaft 11 and the driven shaft 13. This holding and releasing mechanism includes a single slip brake which is adapted to be operated only when the motor shaft 11 is operated. The ring gear 41 is formed integral with a sleeve or quill shaft 42 rotatably supported by bearings 43 and 44 about the driven shaft 13. A splined shoulder 45 is formed on the quill shaft 42 and is engaged by complementary tongue and groove portions 46 of friction brake plates 47. The friction plates 47 are arranged between cooperating brake plates 48 which are provided with tongue and groove portions on their outer peripheries arranged in engagement with a complementary splined inner surface 49 formed on an adjustable brake plate supporting ring 50. These brake plates are adapted to be operated by an electromagnetic actuating member which includes a brake actuating and supporting plate 51 arranged in engagement with one of the outer brake plates 48 and provided with a plurality of operating rods 52 secured to the actuating plate 51 and to an armature 53 formed of magnetic material. The actuating plate 51 and the rods 52 are formed of non-magnetic material so that they will not be affected by the excitation of the electromagnetic brake. The armature 51 is adapted to be actuated by magnetic attraction of a U-section electromagnetic core 54 which is excited by an exciting winding 55 connected in circuit with the windings of the motor 10 and adapted to be energized only when the motor is energized. A retaining ring 56 of non-magnetic material is arranged over the lower side of the exciting coil 55 to retain the coil in position and to exclude foreign substances from the coil enclosure. In order to provide for a release of the driving connection between the motor shaft 11 and the driven shaft 13 above a predetermined torque, the electromagnetic brake is provided with a pressure plate 57 which is arranged to engage the outer side of the brake plate 48 opposite the actuating brake plate 51. This pressure plate 57 is resiliently biased and preloaded by a plurality of coil springs 58 arranged in circumferentially spaced apart relationship in engagement with the outer surface of the pressure plate 57 and an adjustable preloading spring seat and retaining plate 59. These springs are guided and held in their relative positions by openings 60 formed in a guiding ring 61 which is arranged between the pressure plate 51 and the spring seat plate 59 and adapted to move axially relative to the spring seat plate 59. The pressure plate 57 is formed with an outwardly extending flange 62 which is adapted to be biased by the springs 58 against a complementary flange 63 formed on a retaining ring 64 to limit the lowermost position of the pressure plate 57. The retaining ring 64 is formed to act as a guide for the pressure plate 57 and to provide for limited axial movement of the pressure plate 57 relative to the brake plates 48. An adjustment of the pressure plate 57 to provide for wear in the brake plates 46 and 48 is provided for by the threaded engagement of the retaining ring 64 with the threaded internal surface of the brake housing 16. When the motor 10 is energized, the exciting coil 55 of the electromagnetic brake also is arranged to be energized, so as to excite the core 54 and attract the armature 53 toward the core 54 to close the air gap existing therebetween when the coil 55 is deenergized. Under these conditions, the armature 53 moves axially and exerts a pressure against the actuating plate 51 through the rods 52 which in turn exerts a pressure against the brake plates 48, biasing them toward the pressure plate 57 against the pressure of the biasing springs 58. This tends to exert a predetermined pressure by the plates 48 on the complementary plates 46 which tend to hold stationary the quill shaft 42 and consequently the ring gear 41. This causes the planet gears 34 to rotate about their supporting shafts 46 due to the rotation of

the sun gear 33 by the gearing connected to the motor shaft 11, and thereby drives the driven shaft 13 through the planet cage 37 and the planet supporting shafts 48. If for any reason the load on the driven shaft 13 becomes excessive and exceeds a predetermined value, the friction between the brake plates 46 and 48 will not be sufficient to hold stationary the quill shaft 42 and consequently will release the ring gear 41 and rotation of the sun gear 33 will merely result in a rotation of the planet gears 34 about their supporting shafts 36 and a rotation of the ring gear 41 about the sun gear 33, without any resultant rotation of the planet cage 37 or the driven shaft 13, thereby releasing the driving connection between the motor drive shaft 11 and the driven shaft 13. The torque at which the ring gear 41 will be released can be adjusted by adjusting the position of the spring seat plate 59 within the brake housing 16 by adjusting the relative axial position thereof. This is facilitated by providing a threaded engagement between the outer surface of the spring seat plate 59 and the inner threaded surface of the brake housing 16.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A driving mechanism comprising an electric driving motor and a driven member, means including a planetary gearing for providing a driving connection between the motor and the driven member, the planetary gearing including a sun gear adapted to be driven by the motor, a ring gear, and a planet gear arranged in engagement with the sun and ring gears and rotatably supported by the driven member, and electromagnetic brake means responsive to energization of the motor for frictionally holding stationary the ring gear to establish the driving connection only when the motor is energized, the electromagnetic brake means being arranged to maintain the driving connection below a predetermined torque but to disestablish the driving connection by allowing slip of the ring gear to occur when the said predetermined torque is exceeded.

2. A driving mechanism as claimed in Claim 1 in which the electromagnetic brake means comprises a friction plate fixedly connected with the ring gear and a complementary friction plate adapted to be moved into frictional engagement with the first friction plate by means of an electromagnet armature actuated in response to energization of the electromagnet when the driving motor is energised.

3. A driving mechanism as claimed in Claim 1 or Claim 2 in which the electromagnetic brake means is resiliently preloaded.

4. A driving mechanism constructed and adapted to operate substantially as hereinbefore described with reference to the accompanying drawing.

Dated this 17th day of November, 1943.

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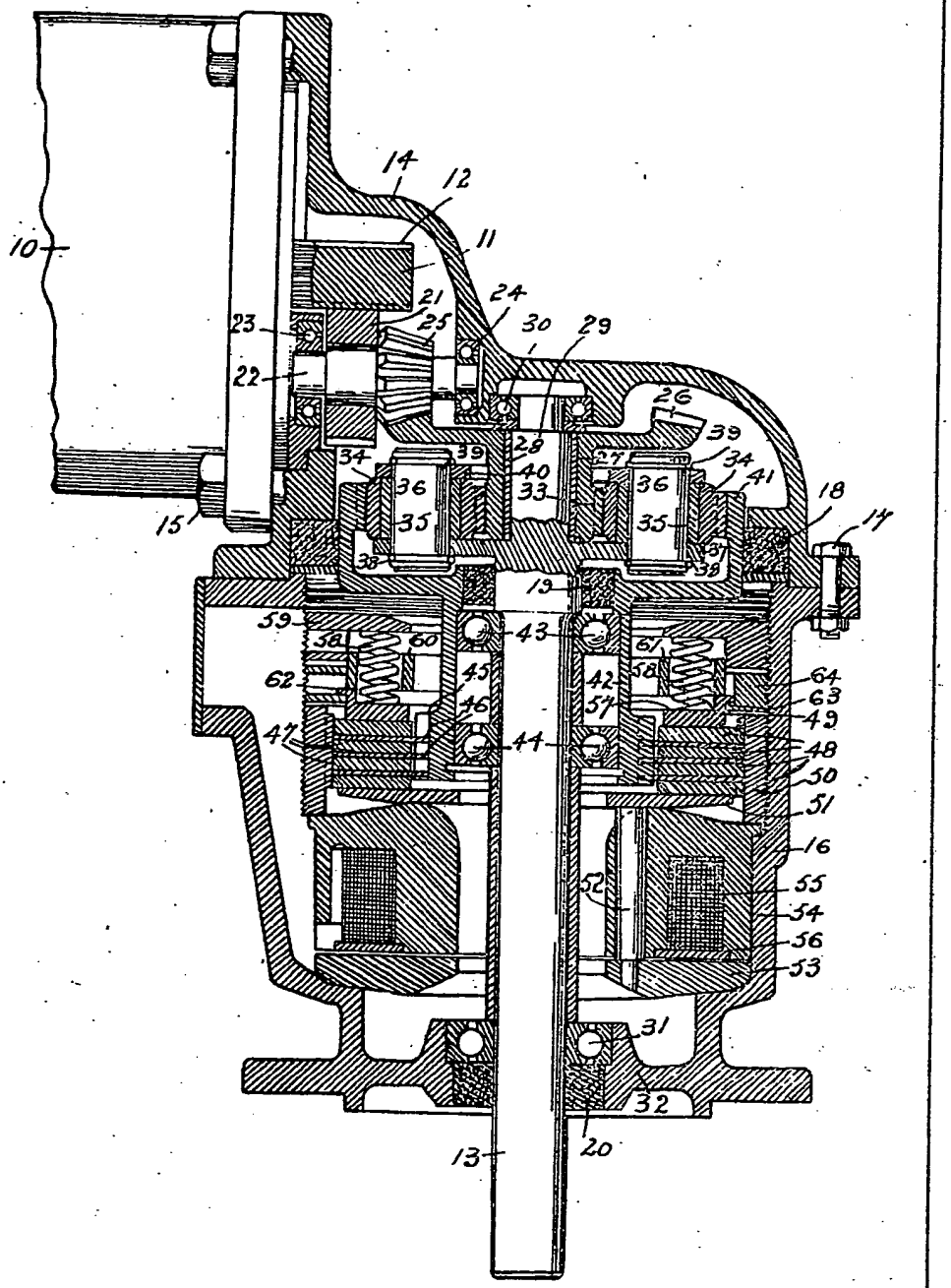

[This Drawing is a reproduction of the Original on a reduced scale.]

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